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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : H04Q 7/38 — A1

(11) International Publication Number: WO 99/07174

(43) International Publication Date: 11 February 1999 (11.02.99)

(21) International Application Number: PCT/US98/15048

(22) International Filing Date: 22 July 1998 (22.07.98)

(30) Priority Data:
60/053,939 28 July 1997 (28.07.97) US
09/120,103 21 July 1998 (21.07.98) US

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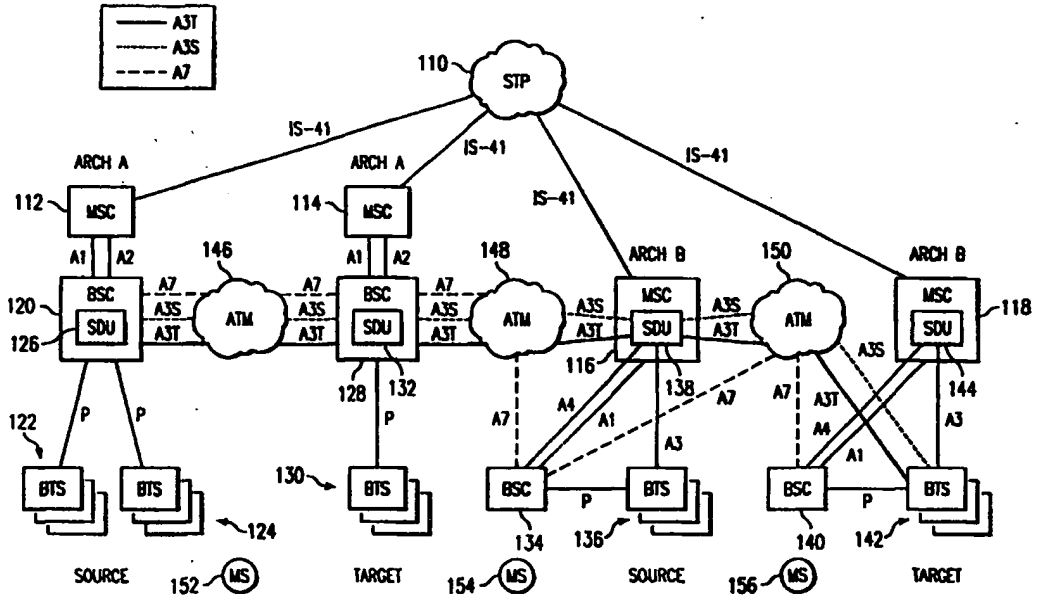
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
With international search report.

(54) Title: SOFT HANDOFF METHOD AND APPARATUS



(57) Abstract

Disclosed is a method and apparatus for establishing an inter–system soft handoff using a direct base station to base station standardized protocol connection over a network which bypasses the time consuming prior art MSC to MSC communication link using the IS–41 protocol. This new protocol has recently received industry agreement for use between different type architecture CDMA systems and uses A7 and A3 protocols as defined in IS–634 rev A.

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SOFT HANDOFF METHOD AND APPARATUS

This Application is a continuation in part of and claims the benefit of U.S. Provisional Application Number 60/053,939, filed 29 July 1997.

TECHNICAL FIELD

The present invention relates in general to soft handoffs and in particular to methods and systems for establishing soft handoffs between two CDMA base stations (BSs) using a direct base station (BS) to BS link even where the SDUs associated to the BS comprise part of different configuration systems.

BACKGROUND

When a mobile station (MS), in a cellular communication system, crosses from one cell to another adjacent cell a process designated as handoff is initiated.

Handoff is the process by which a new air interface channel between a mobile station and a base station is established.

There are several types of handoff in the wireless communication industry. A "hard handoff" is a handoff which requires a mobile station to tune its radio equipment or to reestablish synchronization. A "soft handoff" is a handoff that does not require the mobile station to tune its radio equipment or to reestablish synchronization and that uses the same frame selection function for (and voice trans-coding function, if this is a voice call) in the network for both the old and new air interface channels. Other types of handoffs, such as a semi soft handoff, are not pertinent to an understanding of the present invention. At the present time, only code division multiple access (CDMA) wireless communication systems are capable of accomplishing soft handoffs.

In a CDMA wireless communication system, using cellular transmission technology, the process of establishing a soft handoff from the time an MS sees a new pilot signal, received from a nearby base transceiver station (BTS) defining another cell, to the time an MS

sends a handoff completion message can be segregated into at least three phases.

Phase 1 may be defined as occurring from the time the MS sees a new pilot to the time that the pilot strength exceeds a predetermined threshold and may be referred to as the detection phase. Phase 2 may be defined as occurring between the time an MS sends a pilot strength measurement (PSM) message until it receives a handoff direction message and may be referred to as the establishing phase (when successful). Phase 3 may be defined as the time from when an MS receives a handoff direction message to the time the MS sends a handoff completion message and may be referred to as the completion phase.

As is well-known in the art, many standards are used by the communication industry to define functional standards by which communication equipment will operate so that equipment from various manufacturers may compatibly inter-operate. One such standard is IS-95 Revision A entitled "Mobile Station - Base Station Compatibility Standard for Dual-Mode Wideband Spread Spectrum Cellular Systems; May, 1995". Another standard is IS-634 Rev A ballot version dated April 20, 1997 entitled "MSC BS Interface for Public Wireless Communication" that among other items defines radio access to switch or intr-system interfaces. A further standard mentioned in this document is IS-41-C entitled "Cellular Radiotelecommunications

Intersystem Operations; 1996". Each of these standards are incorporated herein by reference.

The IS-634 standard has defined and standardized communications between a mobile switching center (MSC) and a BS by industry agreement such that different manufacturers equipment could be combined into a composite cellular system by a user. However this standard has not previously attempted to standardize any signaling messages between base stations. Thus, signaling messages bound from a source base station to a target base station, must be first relayed to an MSC in a standardized manner and protocol before being received by the target base station.

To support soft handoff of an MS moving from one cell to another, adjacent cells must operate at the same frequency. Once an MS detects a new pilot, the MS may experience same frequency interference from adjacent cells. In accordance with the standards of IS-95, 12 consecutive bad frames detected by an MS may cause the MS to drop a call. The total network processing time that may cause a call to be dropped is primarily a function of the phase 2 time period. At this time the received signal has already degraded enough that a handoff has been requested. This typically means that the MS is still moving away from its signal source. Thus the degradation of received signal quality, before handoff completion, may result in the occurrence of 12 consecutive bad frames as detected by the MS.

One prior art system used 12 steps and including the transmission of 12 messages for an intra-system inter-BS handoff during phase 2. The series of setup and request messages went from the MS, to the serving BTS, to the selection/distribution unit (SDU), the serving base station controller (BSC), the mobile switching center (MSC), the target BSC, and the target BTS. The response messages came from the target BTS to the target BSC, the MSC, the serving BSC, the SDU and finally the serving BTS.

For an inter-system handoff, at least 14 steps were completed because of the extra MSC and even the STP involved in both directions.

It takes time to successfully transmit a message and to process the message after receipt. It will be apparent that the time required to complete the referenced 14 steps must occur prior to the length of time it takes the MS to move to a position where the quality of the signal received by the MS has degraded to a point whereby the MS detects 12 consecutive bad frames. This time problem is especially severe when the MSC is involved in many administrative tasks other than call processing.

Thus a system whereby the number of steps involved and the number of messages transmitted could be reduced for the establishment process of phase 2 would lessen the chances of a call being dropped due to extensive time required to complete this phase. The elimination of the MSC from the message path, even where there was no reduction in number

of steps involved, due to a required addition of dedicated processing entities, would also reduce the time required to complete phase 2 in some circumstances.

It would further be desirable, if base stations, whether identical or made by different manufacturers, could communicate directly with one another to establish a soft handoff of an MS across cellular boundaries of communication cells managed by different base stations.

One attempt to solve the above problem was presented in a patent application assigned to the assignee of the present invention, filed April 7, 1998, entitled "**METHODS AND SYSTEMS FOR STANDARDIZING INTER BASE STATION COMMUNICATIONS**" and having a filing number designation of 09/056,370.

There are two architectures supported in the referenced IS-634 standard. An Architecture A network infrastructure is distinguished by the fact that the voice coding and frame selection function of the SDU is always located at the source base station. An Architecture B network infrastructure is distinguished by the fact that the voice coding and frame selection function of the SDU is located remote from the source base station and thus requires the use of an A4 communication interface as defined in the standard. A typical location for the SDU in an architecture B network is in the MSC although it may, if

so desired, be physically isolated from the rest of the system.

The above referenced patent application does not address a solution to the quicker establishment of soft handoffs between base stations comprising part of different architecture systems.

SUMMARY OF THE INVENTION

The present invention comprises providing a soft handoff signaling channel or communication link directly between source and target systems. This communication link in combination with an enhanced signaling link from the source SDU to the target BS, operate to permit the transmission of both signaling and voice information from the SDU, and removes the involvement of the MSC from the soft handoff establishing phase process.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and its advantages, reference will now be made in the following Detailed Description to the accompanying drawings, in which:

FIGURE 1 is a basic block diagram illustrating the mechanism whereby a soft handoff occurred in the prior art regardless of network architecture;

FIGURE 2 is a basic block diagram illustrating the mechanism whereby a soft handoff occurred in the prior art between architecture A networks as described in the above referenced patent application;

FIGURE 3 is a basic block diagram illustrating the mechanism for providing a direct link for soft handoff between architecture B networks instead of involving IS-41 in the soft handoff establishing phase;

FIGURE 4 is a basic block diagram illustrating the mechanism for providing a soft handoff between architecture A and architecture B networks;

FIGURE 5 is a block diagram illustrating the mechanism for providing a soft handoff where the source, of an inter-architecture soft handoff, is an architecture B type network;

FIGURE 6 is a block diagram illustrating the mechanism for providing a soft handoff where the source, of an inter-

architecture soft handoff, is an architecture A type network;

FIGURE 7 illustrates, in a message time sequence diagram form, a methodology of the establishment phase of a soft handoff between two type A architecture systems;

FIGURE 8 illustrates, in a message time sequence diagram form, a methodology of the establishment phase of a soft handoff between two type B architecture systems;

FIGURE 9 illustrates, in a message time sequence diagram form, a methodology of the establishment phase of a soft handoff between two systems where the source is a type A architecture and the target is type B architecture; and

FIGURE 10 illustrates, in a message time sequence diagram form, a methodology of the establishment phase of a soft handoff between two systems where the source is a type B architecture and the target is type A architecture.

DETAILED DESCRIPTION

The referenced copending application is directed to the idea of adding a communication link between base stations to bypass or eliminate the requirement of signals passing through the MSC. The concept as presented therein is not readily implementable as applied to CDMA architecture B type systems or to a SHO.between systems having different architecture types.

In this application, separate signaling and traffic links are utilized to allow inter-system soft handoff operations to bypass the MSC whether the systems are both architecture type B, or both type A or between different architecture types.

This is accomplished by using 3 links, as will be explained in greater detail later, A7 signaling, A3 signaling and A3 traffic. Each link may terminate logically at different entities in different architecture type systems. This flexibility of link termination provides the inter-operability necessary in establishing direct links between certain entities in different architecture type systems and as required to remove the involvement of the MSC from the soft handoff establishing phase of the operation.

In FIGURE 1 a block designated as MSC is also labeled 10. MSC 10 is connected via a communication link 12 to a cloud designated as 14 and also labeled STP. STP refers to

a signal transfer point, gateway or other signal switching network such as the public switched telephone network (PSTN). The link 12 transfers data according to an IS-41 protocol as referenced in the previously mentioned industry standard. Cloud 14 is further connected via a link 16 to a further MSC block 18. Link 16 also conforms to the IS-41 protocol. A base station block 20 is connected via a communication link 22 to MSC 18. The communication link 22 conforms to IS-634 standards. A further base station 24 is connected via a communication link 26 to MSC 10. Link 26 also conforms to the IS-634 protocol. A circle 28 represents a mobile station (MS) that is moving from the base station 24 towards base station 20. An airwave communication link 30 represents communications between MS 28 and base station 24. A dash line 32 represents airwave communications between MS 28 and base station 20. The cellular system represented by blocks 10 and 24 may be either an architecture A or architecture B type system as defined in IS-634. As shown in the drawing, the same applies to a second cellular system represented by blocks 18 and 20.

Figure 2 provides the basic components involved in a soft handoff between two systems conforming to architecture A. This is the model used in the referenced patent application. An MSC block 40 communicates over a link 42, through a cloud 44 and a further link 46 with a second MSC 48 in the same manner as shown in FIGURE 1. MSC 40 also

communicates with a BS 50 over a link 52 conforming to IS-634 standards. A further BS 54 communicates with MSC 48 over a communication link 56 where 56 is IS-634 compliant. Both BSs 50 and 54 actually comprise at least one BSC and normally a plurality of BTSs. A communication link is shown providing a direct connection between a voice and signaling (V/S) portion of BS 50 and a similar portion of BS 54. The V/S portion in most CDMA systems comprise an SDU and associated soft handoff controller (SHC). A interconnection function (ICF) block (not shown) may be required in older system designs to transmit data over the link 58 in a protocol that complies with an accepted industry standard.

As shown in FIGURE 1, the mobile station 28 has been communicating with base station 24. As MS 28 moves towards the base station 20, the mobile station 28 receives pilot signals from BS 20 of increasing amplitude. When the signals exceeded a predefined value, the mobile station 28 informs base station 24 that it wants to be transferred to the system represented by base station 20. The base station 24 informs MSC 10 which transfers messages over communication link 12 through STP 14 and eventually to BS 20. BS 20 allocates resources so that it may communicate with mobile station 28. Messages are then sent back through STP 14 to base station 24 to acknowledge that BS 20 is prepared to complete a connection with mobile station 28. The process of transferring these messages and the

many steps involved, when using only MSC to MSC communication, is set forth in detail in the referenced patent application.

The referenced patent application is directed to the idea of providing direct BS to BS signaling to establish the soft handoff connection. As presented, the invention suggested that one method of accomplishing this soft handoff signaling link is to enhance an existing voice and signaling communication channel designated in the standards as A3. Such a system is illustrated in FIGURE 2.

FIGURE 3 shows the same concept applied to a handoff between architecture B type systems. As shown, one system comprises an MSC 70 and a BS 72. A second system comprises an MSC 74 and a BS 76. IS-41 links connect the two MSCs together via an STP cloud 78. A direct link labeled as 80 provides signaling and voice communication between the appropriate components of the two systems necessary to establish a soft handoff. Non designated communication links interconnect the MSC and its associated BS and these links are IS-634 compliant. While the number of message steps saved may be slightly less than occurs between two architecture A systems, the time saved may still be significant.

A further significant advantage will be apparent from an examination of FIGURE 4 where a soft handoff is shown occurring between two different architecture type systems. An architecture B system is shown having the basic

components of an MSC 90 and a BS 92. An architecture A system is shown having the basic components of an MSC 94 and a BS 96. IS-41 links connect the two MSCs together via an STP cloud 98. A V/S to V/S direct link labeled as 100 provides signaling and voice communication between the appropriate components of the two systems necessary to establish a soft handoff. Non designated communication links interconnect the MSC and its associated BS and these links are IS-634 compliant.

By setting up a standardized protocol whereby each of the links 58, 80 and 100 in the appropriate FIGURES 2, 3 and 4 conform to the same communication standard, any architecture type system may establish a soft handoff with another system without having to pass the establishing messages to the STP cloud.

The inter-operability approach set forth in FIGURE 4 is expanded upon in FIGURES 5 and 6 and the manner in which messages are exchanged between systems for four different source and target combination possibilities is presented in FIGURES 7 through 10.

In FIGURE 5, a network or switch mechanism labeled as STP and given a designation of 110 is connected to each of a plurality of MSC blocks 112, 114, 116 and 118 over IS-41 compliant communication links. MSCs 112 and 114 provide the main switch function for two architecture A type cellular systems. MSCs 116 and 118 provide the main switch function for two architecture B type cellular systems.

Each of the MSCs is connected to base station equipment over IS-634 compliant communication links. MSC 112 controls a BSC 120 which in turn controls a first plurality of BTSs 122 and a second plurality of BTSs 124. Internal to BSC block 120 there is shown an SDU block 126.

MSC 114 controls a BSC 128 which in turn controls a plurality of BTSs 130. Internal to BSC block 128 there is shown an SDU block 132. MSC 116 controls a BSC 134 which in turn controls a plurality of BTSs 136. Internal to MSC block 116 there is shown an SDU block 138. MSC 118 controls a BSC 140 which in turn controls a plurality of BTSs 142. Internal to MSC block 118 there is shown an SDU block 144.

Three asynchronous transfer mode (ATM) clouds 146, 148 and 150 provide direct V/S to V/S interconnection between the four cellular systems. The connections are shown as solid, dashed and dotted lines for different types of communications. The bold solid lines designated A3T represents A3 protocol voice or data (traffic) packets, the dotted line designated as A3S represents A3 protocol signaling data packets and the dash line designated as A7 represents a data packet protocol for passing resource allocation signaling type messages.

Three different MS blocks are designated as 152, 154 and 156. MS 152 is shown as being handed off from a source system using one of the BTSs 124 to a target system using one of the BTSs 130. Similarly, MS 154 is shown as being

handed off from one of a set of source BTS 136 to one of the set of target BTSs 130. Finally, MS 156 is illustrated as being handed off from one of the source BTSs 136 to one of the target BTSs 142.

The cellular systems using BSCs 120 and 134 are further labeled SOURCE while the systems using BSCs 128 and 140 are further labeled TARGET in accordance with the above paragraph. The A3 and A7 communication links as shown are used to help illustrate the paths messages travel in performing a soft handoff between a source system and a target system in the practice of this invention.

When the source and target systems are both architecture A type systems all communications take place between the BSCs as shown in connection with ATM 146. The A3 protocol signaling and voice messages are transferred between the BSs in each of the two systems. The A7 resource allocation messages are transferred between the soft handoff controllers internal the respective BSCs to transfer a handoff request and the response acknowledgement to that request between the appropriate BTS entities.

In FIGURE 6, a network or switch mechanism labeled as STP and given a designation of 200 is connected to each of a plurality of MSC blocks 202, 204, 206 and 208 over IS-41 compliant communication links. MSCs 202 and 204 provide the main switch function for two architecture A type cellular systems. MSCs 206 and 208 provide the main switch function for two architecture B type cellular systems.

Each of the MSCs is connected to base station equipment over IS-634 compliant communication links. MSC 202 controls a BSC 210 which in turn controls a first plurality of BTSs 212 and a second plurality of BTSs 214. Internal to BSC block 210 there is shown an SDU block 216.

MSC 204 controls a BSC 218 which in turn controls a plurality of BTSs 220. Internal to BSC block 218 there is shown an SDU block 222. MSC 206 controls a BSC 224 which in turn controls a plurality of BTSs 226. Internal to MSC block 206 there is shown an SDU block 228. MSC 208 controls a BSC 230 which in turn controls a plurality of BTSs 232. Internal to MSC block 208 there is shown an SDU block 234.

Three asynchronous transfer mode (ATM) clouds 236, 238 and 240 provide direct V/S to V/S interconnection between the four cellular systems. The connections are shown as solid, dashed and dotted lines for different types of communications. The bold solid lines designated A3T represents A3 protocol voice (traffic) data packets, the dotted line designated as A3S represents A3 protocol signaling data packets and the dash line designated as A7 represents a data packet protocol for passing resource allocation signaling type messages.

Three different MS blocks are designated as 242, 244 and 246. MS 242 is shown as being handed off from a source system using a BTS such as 220 to a target system using one of the BTSs such as 214. Similarly, MS 244 is shown as

being handed off from one of a set of source BTSs 220 to one of the set of target BTSs 226. Finally, MS 246 is illustrated as being handed off from one of the source BTSs 232 to one of the target BTSs 226.

The cellular systems using BSCs 218 and 230 are further labeled SOURCE while the systems using BSCs 210 and 224 are further labeled TARGET in accordance with the above paragraph. The A3 and A7 communication links as shown are used to help illustrate the paths messages travel in performing a soft handoff between a source system and a target system in the practice of this invention.

When the source and target systems are both architecture A type systems, all communications take place between the BSCs as shown in connection with ATM 236 in the same manner as discussed in connection with FIGURE 5. The same holds true when the source and target systems are both architecture B type systems. The differences occur when the source and target systems are of different types. This will be further explained in connection with the following figures.

In FIGURE 7 an MS is labeled 300 and is shown sending a pilot strength measurement signal to a BS block 302 which represents a combination of BTS/SDU/SHC/ICF entities since the communication link interconnections of these entities are proprietary to each manufacturer. The block 302 and an MSC1 block 304 represent a source system. An MSC2 block 306 in combination with a BS block 308 represents a target

system. As above the block 308 represents a combination of BTS/SDU/SHC/ICF entities. As mentioned previously, the messages passed illustrate the time sequence of messages, labeled from "a" to "l", when a soft handoff is being established between two type A systems. This would be representative of a soft handoff between the two left hand systems of either FIGURES 5 or 6. When the source BS determines that one or more cells at a target BS are needed to support an already established call, it sends an A7 Handoff Request to the target BS as shown in line "b". The target BS initiates an A3S connection by sending a Connect message in return. (Although only one connect message is shown, multiple connect messages may occur if the request includes multiple cells.) Acknowledgments soon follow both the HO request and connect messages. Forward frames are commenced from the source to the target BS as shown in line "f" as soon as synchronization is established. A message is then sent to the target BS to begin forwarding traffic frames to the MS as set forth in lines "g" and "h". An acknowledgement message is sent in line "j". After the extended HO direction message is sent, the source MSC is informed that the HO has been performed. As set forth above, the MSC is bypassed from the establishment phase and is merely informed that the HO is complete after the fact.

The messages used in the establishment phase of a soft handoff between B architecture type systems in accordance with this invention are presented in FIGURE 8. As

mentioned previously, the SDU in B architecture type systems is not located in the base station. It may be isolated by itself but is often found in proximity to an MSC as shown in both FIGURES 5 and 6. A MS labeled as 350 may represent either MS 156 in FIGURE 5 or MS 246 in FIGURE 6. A BSC block 352, an SDU block 354 and an MSC1 block 356 represent a source system through which the MS 350 has been communicating. In FIGURE 5 this would be the system having MSC 116 while in FIGURE 6 it would be the system having MSC 208. A MSC2 block 358, a BSC block 360 and a BTS block 362 represent a target system such as shown and labeled in FIGURES 5 and 6. As shown, the pilot strength measurement signal is sent to the SDU 354 via an A3 communication link. As will be apparent to those skilled in the art, the A3 communication link is distinct from the previously discussed A3S and A3T communication links although the protocol used is the same. A HO Request, as shown on line "c", is sent on an A4 communication link to the BSC represented by 352. This request is then forwarded, as shown on line "d", over the A7 communication link to BSC 360 and is forwarded over a proprietary link to the BTS 362 representing an appropriate target BTS. A connect signal is returned to the source SDU 354 over an A3S communication link as shown on line "e". The remaining signals utilized in establishing SHO in a type B architecture system are shown and a comparison with either FIGURE 5 or 6 will disclose the signal paths used to

provide the communication link. As before, the MSC is not involved until the handoff is completed and a HO performed message is sent from the BSC to the MSC as shown in line "o" over communication link A7. The signaling messages are substantially identical in both FIGURES 7 and 8 although some need to be forwarded in accordance with established protocols over standardized communication links, such as A4 and A3.

In FIGURE 9, a signal transfer methodology is shown for establishing a SHO between a source type B architecture system and a target type B architecture system. A block 400 represents an MS such as 154 in FIGURE 5. A BSC block 402, an SDU block 404 and an MSC1 block 406 represents components of the source system in FIGURE 5 having MSC 116. A target MSC2 block 408 and a BSC block 410 are representative of the system shown having MSC 114. As in FIGURE 7, the block 410 includes at least the functional entities ICF, SHC and BTS used to respond to the intersystem messages used in this invention. In a manner identical to FIGURE 8, the BSC 402 forwards a HO request message subsequent to the occurrence of an appropriate pilot strength measurement message of line "a" and a resulting HO request message of line "b". This HO request message is received over communication link A7 from a BSC such as 134 in FIGURE 5. A connect message, as shown on line "d", is returned over an A3S communication link to the SDU such as 138. As shown, acknowledgment message of lines

"e" and "f" are sent over communication links A3S and A7 respectively to the entities shown. The remaining messages and communication links used are self evident in view of the material already discussed.

The messages provided in FIGURE 10 illustrate the entities involved in establishing a SHO between a source architecture A type system and a target architecture B type system such as may occur in connection with MS 244 in FIGURE 6. A block 450 represents an MS while a BS block 452 and a MSC1 block 454 represent a source system through which the MS has been communicating. The BS block 452 includes, as before, at least entities such as a BTS, a SDU, a SHC and an ICF. A target system is represented by MSC2 block 456, a BSC block 458 and a BTS block 460. The HO request message is sent over the A7 communication link to BSC 458 which is inherently programed to forward same over a communication link, proprietary to type B architecture systems, to a BTS as represented by block 460 and such as one of those designated as 226 in FIGURE 6. A connect signal is returned over the A3S communication link and then acknowledgments follow as described previously, The remaining messages are transmitted and, when the SHO operation is completed, a message is sent to the MSC 454 and designated as 204 in FIGURE 6 that the HO has been performed. Thus the MSC again is not involved in the establishment phase until it is completed and thus does not

act to impede the time required to complete the SHO operation.

The present invention thus establishes a methodology that not only bypasses the MSC when attempting a SHO operation between type A architecture systems as shown in the referenced patent application, but allows the MSC bypassing when attempting a SHO between different type systems. A standardized set of signals is set forth herein whereby all CDMA systems can communicate for the purpose of establishing a SHO without involving the MSC.

For the messages involved in the establishing phase as well as in the release phase, Appendix A provides an example set of message-layout and information elements.

Although the invention has been described with reference to specific embodiments, these descriptions are not meant to be construed in a limiting sense. Various modifications of the disclosed embodiments, as well as alternative embodiments of the invention, will become apparent to persons skilled in the art upon reference to the description of the invention. It is therefore, contemplated that the claims will cover any such modifications or embodiments that fall within the true scope and spirit of the invention.

Appendix: Message Layout and Information Elements

Note: The section numbers are referred to IS-634 rev A ballot version, dated April 20, 1997.

6.1.x.x PMC_A3 HO Request

This message is sent from the source BS to the target BS to indicate that for a given MS which already has a dedicated radio resource assigned, a handoff is required.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Source BS -> Target BS	M
Call Connection Reference	Section 6.2.2.98	Source BS -> Target BS	M
IS-95 Channel Identity	Section 6.2.2.10	Source BS -> Target BS	M
Cell Identity	Section 6.2.2.20	Source BS -> Target BS	M
Tag	Section 6.2.2.62	Source BS -> Target BS	O
SDU ID	Section 6.2.2.91	Source BS -> Target BS	O
SDU_Node ID	Section 6.2.2.90	Source BS -> Target BS	O
Mobile Identity (ESN)	Section 6.2.2.16	Source BS -> Target BS	O[h]
Public Long Code	Section 6.2.2.xx	Source BS -> Target BS	O
Encryption Information	Section 6.2.2.12	Source BS -> Target BS	O
Downlink Radio Environment	Section 6.2.2.25	Source BS -> Target BS	O[j]
Service Option	Section 6.2.2.66	Source BS -> Target BS	O
CDMA Serving One Way Delay	Section 6.2.2.79	Source BS -> Target BS	O
Service Configuration Record	Section 6.2.2.109	Source BS -> Target BS	O[j]
Private Parameters	Section 6.2.2.24	Source BS -> Target BS	O

a. Allowable cause values are: Soft handoff; Uplink quality; Uplink strength; Downlink quality; Downlink strength; Distance; Interference; better cell (i.e., Power budget); response to MSC invocation; OAM&P intervention; *IS-41* invocation; private options.

b. This element contains the preferred list of target cells in order of predicted best performance.

c. This element indicates the signaling modes the mobile is capable of operating in.

d. Used for *IS-95* soft handoff procedures, when the source BS needs to convey sub-rate circuit information to the target BS. A maximum of 5 instances of this element can be included in this message.

e. Conveys current Voice Privacy mode, as well as either Voice Privacy or Signaling Message Encryption Keys, if applicable.

f. This element provides the signaling type that the mobile is currently using. Only one is permitted.

g. Specifies the current *IS-95* Channel(s).

h. This element is required for *IS-95* handoff and must contain the mobile's ESN, so that the target BS can calculate the Public Long Code Mask. A maximum of two instances of this element may be included, in which case the first instance will contain the MIN/IMSI.

i. This element provides information for each cell in the Cell Identifier List element.

j. Only required for multi-cell BS's. Discriminator types 1, 2 or 5 must be used.

k. This element indicates the current frequency band that the MS is operating on.

l. This element indicates the requested service configuration.

m. These elements are required when a packet mode channel is being used to support the call.

6.1.x.x PMC_A3 HO Request Ack

This message is sent from the target BS to the source BS, in response to the PMC HO Request, to indicate that a target channel has been allocated for handoff as requested. This message is also used to initiate a layer 3 connection to support the tansfer of user information for a newly added radio link in soft handoff.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target_BS -> Source_BS	M
Call Connection Reference	Section 6.2.2.98	Target_BS -> Source_BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target_BS -> Source_BS	M
Cell Identity	Section 6.2.2.20	Target_BS -> Source_BS	M
CE ID	Section 6.2.2.xx	Target_BS -> Source_BS	M
CE_Node ID	Section 6.2.2.xx	Target_BS -> Source_BS	M
A3_Traffic Circuit ID	Section 6.2.2.96	Target_BS -> Source_BS	M
A3_Traffic Connection ID	Section 6.2.2.97	Target_BS -> Source_BS	M
Tag	Section 6.2.2.62	Target_BS -> Source_BS	O
SDU ID	Section 6.2.2.91	Target_BS -> Source_BS	O
SDU_Node ID	Section 6.2.2.90	Target_BS -> Source_BS	O
PMC_A3 Cell Information Record	Section 6.2.2.89	Target_BS -> Source_BS	O
Extended Handoff Direction Parameters	Section 6.2.2.73	Target_BS -> Source_BS	O
Forward Power Control Parameters	Section 6.2.2.69	Target_BS -> Source_BS	O
Neighbor List	Section 6.2.2.83	Target_BS -> Source_BS	O[a]
Handoff Type	Section 6.2.2.88	Target_BS -> Source_BS	O
Service Configuration Record	Section 6.2.2.109	Target_BS -> Source_BS	O[b]
PMC Cause	Section 6.2.2.99	Target_BS -> Source_BS	
Private Parameters	Section 6.2.2.24	Target_BS -> Source_BS	O

a. Included if the air interface channel allocated by the target is *ANSI/EIA/TIA-553, IS-91, IS-54.*

b. Included if the air interface channel allocated by the target is *IS-95.* It lists *IS-95* channels that have been allocated by the target BS.

c. A maximum of 5 Channel Number elements may be included in this message.

d. Needed by source BS for soft handoff (SHO) Drop Target message and for Handoff Performed message.

e. Included if an *IS-95* soft handoff procedure is being performed for a call that requires a terrestrial circuit. A maximum of 5 instances of this element may be included. The order of the circuit identities must match the order of the Channel Number elements and the order of the *IS-95* channels listed in the *IS-95* Channel ID element, so that the source BS can determine which circuit is connected to which target *IS-95* channel.

f. For *IS-54* only.

g. For *IS-95* soft handoff drop source procedure. The target BS may propose an alternative Transcoder Handoff Time to the source BS.

h. For *IS-136* only.

i. This element indicates the granted service configuration.

j. Included if an *IS-95* soft handoff procedure is being performed. A maximum of 5 instances of this element may be included. The order of the Neighbor List elements shall match the order of the Channel Number elements and the order of the *IS-95* channels listed in the *IS-95* Channel ID element, so that the source BS can determine which neighbor list is associated with which target *IS-95* channel.

6.1.5.12 Handoff Performed

This BSMAP message is sent from the BS to the MSC in order to indicate that the BS has performed a handoff. In case of soft handoff, this message is sent from source BS to the source MSC only when the reference cell has been changed upon completion of the new handoff. The handoff may have been internal or in conjunction with another BS. The purpose of this message is to update the call configuration for the MSC. The Cell Identifier List and channel identities are optionally included for billing, trace, court ordered surveillance, etc.

Information Element	Reference	Direction	Type
Message Type	Section 6.2.2.4	BS -> MSC	M
Cause	Section 6.2.2.19	BS -> MSC	M[a]
RF Channel Identity	Section 6.2.2.8	BS -> MSC	O
IS-95 Channel Identity	Section 6.2.2.10	BS -> MSC	O
Channel Number	Section 6.2.2.6	BS -> MSC	O[b]
Cell Identifier List	Section 6.2.2.21	BS -> MSC	O[c]
Call Connection Reference	Section 6.2.2.98	BS -> MSC	O[d]

a. Allowable cause values are: Uplink quality, Uplink strength, Downlink quality, Downlink strength, Distance, Interference, Better cell (i.e., Power budget), Response to MSC invocation, OAM&P Intervention, or Private options. For *IS-95* soft handoff procedures: Inter-BS soft handoff drop target; Inter-BS soft handoff add target; Intra-BS soft handoff drop target; Intra-BS soft handoff add target; Equipment Failure.

b A maximum of 6 Channel Number elements may be included in this message.

c. For *IS-95*, all cells currently supporting the call appear in this list. The first cell on the list is the reference cell. The algorithm of determining of a reference cell is on discretion of BS manufacturers. For *ANSI/EIA/TIA-553* and *IS-91*, only one cell can be specified.

d. This element is required when a packet mode channel is being used to support the call.

6.1.9.x PMC_A3 Begin FWD Traffic

This packet mode channel message is sent from the source BS to the target BS to acknowledge successful completion of the Packet Mode Channel connect operation. This message also triggers the transmission of forward traffic frames at the target BS. If an error has occurred in the operation, the PMC Cause element indicates the reason for the failure.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Source BS->Target BS	M
Call Connection Reference	Section 6.2.2.98	Source BS->Target BS	M
IS-95 Channel Identity	Section 6.2.2.10	Source BS->Target BS	M
Cell Identifier	Section 6.2.2.20	Source BS->Target BS	M
CE_ID	Section 6.2.2.xx	Source BS->Target BS	M
CE_Node ID	Section 6.2.2.xx	Source BS->Target BS	M
Tag	Section 6.2.2.62	Source BS->Target BS	O
SDU ID	Section 6.2.2.91	Source BS->Target BS	O
SDU_Node ID	Section 6.2.2.90	Source BS->Target BS	O
PMC Cause	Section 6.2.2.99	Source BS->Target BS	O[a]

a. The PMC Cause element must be present if a failure has occurred. Its absence implies success.

6.1.9.x PMC_A3 Begin FWD Traffic Ack

This packet mode channel message is sent from the target BS to the source BS to acknowledge PMC_A3 Begin FWD Traffic Ack.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target_BS -> Source_BS	M
Call Connection Reference	Section 6.2.2.98	Target_BS -> Source_BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target_BS -> Source_BS	M
Cell Identifier	Section 6.2.2.20	Target_BS -> Source_BS	M
CE_ID	Section 6.2.2.xx	Target_BS -> Source_BS	M
CE_Node ID	Section 6.2.2.xx	Target_BS -> Source_BS	M
Tag	Section 6.2.2.62	Target_BS -> Source_BS	O
SDU ID	Section 6.2.2.91	Target_BS -> Source_BS	O
SDU_Node ID	Section 6.2.2.90	Target_BS -> Source_BS	O

PMC Cause	Section 6.2.2.99	Target_BS -> Source_BS	O[a]

a. The PMC Cause element must be present if a failure has occurred. Its absence implies success.

6.1.9.X PMC_A3 Channel Count

This packet mode channel message is sent from the source BS to the target BS to indicate the number of IS-95 channels involved in a call.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Source BS->Target BS	M
Call Connection Reference	Section 6.2.2.98	Source BS->Target BS	M
IS-95 Channel Identity	Section 6.2.2.10	Source BS->Target BS	M
Cell Identifier	Section 6.2.2.20	Source BS->Target BS	M
CE_ID	Section 6.2.2.xx	Source BS->Target BS	M

CE_Node ID	Section 6.2.2.xx	Source BS->Target BS	M
Power Control Subchannel Coount	Section 6.2.2.	Source BS->Target BS	M
Tag	Section 6.2.2.62	Source BS->Target BS	O
SDU ID	Section 6.2.2.91	Source BS->Target BS	O
SDU_Node ID	Section 6.2.2.90	Source BS->Target BS	O

6.1.9.x PMC_A3 Receving_Reverse Frame

This packet mode channel message is sent from the target BS to the source BS to indicate receving of reverse frames at the target BS.

1
2
3

4 **6.1.9.x PMC_A3 Drop Target**

5 This packet mode channel message is sent from the source BS to the target BS to request a
6 soft handoff leg to be droped. This may or may not result in the disconnection of A3
7 connection depending on whether a consolidation/soft combining is applied at the target
8 BS.
9

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Source BS -> Target BS	M
Call Connection Reference	Section 6.2.2.98	Source BS -> Target BS	M
IS-95 Channel Identity	Section 6.2.2.10	Source BS -> Target BS	M
Cell Identifier	Section 6.2.2.20	Source BS -> Target BS	M
CE_ID	Section 6.2.2.xx	Source BS -> Target BS	M
CE_Node ID	Section 6.2.2.xx	Source BS -> Target BS	M
A3_Traffic Circuit ID	Section 6.2.2.96	Source BS -> Target BS	M
A3_Traffic Connection ID	Section 6.2.2.97	Source BS -> Target BS	M
Tag	Section 6.2.2.62	Source BS -> Target BS	O
SDU ID	Section 6.2.2.91	Source BS -> Target BS	O
SDU_Node ID	Section 6.2.2.90	Source BS -> Target BS	O
PMC_A3 Cell Information Record	Section 6.2.2.89	Source BS -> Target BS	O
PMC Cause	Section 6.2.2.99	Source BS -> Target BS	O[a]

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target BS -> Source BS	M
Call Connection Reference	Section 6.2.2.98	Target BS -> Source BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target BS -> Source BS	M
Cell Identifier	Section 6.2.2.20	Target BS -> Source BS	M
CE_ID	Section 6.2.2.xx	Target BS -> Source BS	M
CE_Node ID	Section 6.2.2.xx	Target BS -> Source BS	M
Tag	Section 6.2.2.62	Target BS -> Source BS	O
SDU ID	Section 6.2.2.91	Target BS -> Source BS	O
SDU_Node ID	Section 6.2.2.90	Target BS -> Source BS	O
PMC Cause	Section 6.2.2.99	Target BS -> Source BS	O[a]

a. The PMC Cause element must be present if a failure has occurred. Its absence implies success.

6.1.9.x PMC_A3 Drop Target Ack

This packet mode channel message is sent from the target BS to the source BS to acknowledge successful completion of a soft handoff drop target. If an error has occurred in the operation, the PMC Cause element indicates the reason for the failure.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target BS -> Source BS	M
Call Connection Reference	Section 6.2.2.98	Target BS -> Source BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target BS -> Source BS	M
Cell Identifier	Section 6.2.2.20	Target BS -> Source BS	M
CE_ID	Section 6.2.2.xx	Target BS -> Source BS	M
CE_Node ID	Section 6.2.2.xx	Target BS -> Source BS	M
A3_Traffic Circuit ID	Section 6.2.2.96	Target BS -> Source BS	M
A3_Traffic Connection ID	Section 6.2.2.97	Target BS -> Source BS	M
Tag	Section 6.2.2.62	Target BS -> Source BS	O
SDU ID	Section 6.2.2.91	Target BS -> Source BS	O
SDU_Node ID	Section 6.2.2.90	Target BS -> Source BS	O
PMC Cause	Section 6.2.2.99	Target BS -> Source BS	O[a]

a. The PMC Cause element must be present if a failure has occurred. Its absence implies success.

6.1.9.6 PMC_A3 Propagation Delay Measurement Report

This message is sent from the BS(CE)to the SDU immediately following the acquisition of the mobile and subsequently whenever the delay changes by two or more PN chips.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target BS -> Source BS	M
Call Connection Reference	Section 6.2.2.98	Target BS -> Source BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target BS -> Source BS	M
Cell Identifier	Section 6.2.2.20	Target BS -> Source BS	M
CE ID	Section 6.2.2.xx	Target BS -> Source BS	M
CE_Node ID	Section 6.2.2.xx	Target BS -> Source BS	M
One Way Progation Delay Record	Section 6.2.2.119	Target BS -> Source BS	M
Tag	Section 6.2.2.62	Target BS -> Source BS	O
SDU ID	Section 6.2.2.91	Target BS -> Source BS	O
SDU_Node ID	Section 6.2.2.90	Target BS -> Source BS	O

6.1.9.11 PMC_A3 CDMA Long Code Transition Directive

This message is sent from the source BS to the target BS over the A3 interface. It conveys the long code masks type (public or private) as well as the code itself to be used by the the target BS. It also provides the expected time of transition to the new long code mask.

Information Element	Reference	Direction	Type
PMC Message Type)	Section 6.2.2.5	Source BS -> Target BS	M
Call Connection Reference	Section 6.2.2.98	Source BS -> Target BS	M
IS-95 Channel Identity	Section 6.2.2.10	Source BS -> Target BS	M
Cell Identifier	Section 6.2.2.20	Source BS -> Target BS	M
CE ID	Section 6.2.2.xx	Source BS -> Target BS	M
CE_Node ID	Section 6.2.2.xx	Source BS -> Target BS	M
PMC CDMA Long Code Transition Record	Section 6.2.2.128	Source BS -> Target BS	M
Encryption Information	Section 6.2.2.12	Source BS -> Target BS	M
Tag	Section 6.2.2.62	Source BS -> Target BS	O
SDU ID	Section 6.2.2.91	Source BS -> Target BS	O
SDU_Node ID	Section 6.2.2.90	Source BS -> Target BS	O

6.1.9.12 PMC_A3 CDMA Long Code Transition Directive Ack

This message is sent from the BS(CE) to the SDU over the A3 signaling interface to convey the outcome of processing PMC_A3 CDMA Long Code Transition Directive Ack.

Information Element	Reference	Direction	Type
PMC Message Type	Section 6.2.2.5	Target BS -> Source BS	M
Call Connection Reference	Section 6.2.2.98	Target BS -> Source BS	M
IS-95 Channel Identity	Section 6.2.2.10	Target BS -> Source BS	M
Cell Identifier	Section 6.2.2.20	Target BS -> Source BS	M
CE ID	Section 6.2.2.xx	Target BS -> Source BS	M
CE_Node ID	Section 6.2.2.xx	Target BS -> Source BS	M
Encryption Information	Section 6.2.2.12	Target BS -> Source BS	M
Tag	Section 6.2.2.62	Target BS -> Source BS	O
SDU ID	Section 6.2.2.91	Target BS -> Source BS	O
SDU_Node ID	Section 6.2.2.90	Target BS -> Source BS	O
PMC Cause	Section 6.2.2.99	Target BS -> Source BS	O[a]

a. Allowable PMC Cause values are: Private long code not available or not supported.

6.2.2.10 *IS-95* Channel Identity

This element specifies identity information for one or more *IS-95* radio channels.

7	6	5	4	3	2	1	0	Octet
Element Identifier								1
Length								2
Hard Handoff	Number of Channels to Add			Frame Offset				3.
Walsh Code Channel Index								4n
Pilot PN Code (low part)								4n+1
Pilot PN Code (high part)	Power Combined	Freq. Included	Rate Set	Reserved	Band Class	ARFCN (high part)		4n+2
ARFCN (low part)								4n+3

Length is the number of octets that follow this octet. The length of this element is variable because more than one target cell may be requested in an *IS-95* handoff. Therefore, this element provides the flexibility to specify multiple *IS-95* channels that the target BS can accommodate.

The Hard Handoff field, when set to 1, indicates that a hard handoff is required rather than a soft handoff. This field may be set in a handoff request or response. It must be set appropriately by the responding target BS to correspond to the action committed by the target. If the Handoff Type element is also present in the same message, the value of Handoff Type must agree with the setting of this bit.

The Number of Channels To Add field is used to limit the number of soft handoff connections to the source transcoder/selection entity capabilities (i.e., more target cells may be specified in the Cell Identifier List than can be physically supported). The maximum value of this field is 5. This field is only relevant to a soft handoff addition request.

The Frame Offset field will contain the number of 1.25 ms frames relative to system time that the forward and reverse traffic channels are delayed by the source. If this element is returned to the source with the hard handoff indicator bit set, this field will contain the frame offset delay required by the target.

The Walsh Code Channel Index specifies one of 64 possible Walsh Codes used to channelize the downlink RF bit stream in an *IS-95* call.
Octets 4n+1 and 4n+2 contain the Pilot PN Code. The Pilot PN Code is one of 511 unique values for the Pilot Channel offset. The offsets are in increments of 64 PN chips.

The Power Combined field is a flag that, when set to "1", indicates that the power control sub-channel of this *IS-95* code channel should be diversity combined with the previous *IS-95* code channel listed in this element. In other words, if this is the second replication of octets 4n through 4n+3, then the power control sub-channel of this *IS-95* code channel should be diversity combined with power control sub-channel of the previous replication of octets 4n through 4n+3. The first occurrence of this field in the *IS-95* Channel Identity element is set to zero.

Frequency Included is a flag indicating whether the frequency assignment is included. A "0" indicates no frequency assignment is present, a "1" indicates a frequency assignment is present and is specified in the ARFCN field of this element. For code channel assignments that are on the same *IS-95* channel frequency, this field shall be set to "0".
The Rate Set field is coded as follows:

0: Rate Set 1
1: Rate Set 2

The Band Class field is coded as follows:

0: A band
1: B band

The ARFCN (Absolute RF Channel Number) in octets 4n+2 and 4n+3 identifies the *IS-95* frequency being used in the current mobile connection. This ARFCN has a range of 0-1023 to accommodate the frequency bands of each signaling system. The frequency bands are shown below for clarification.

The frequency bands reserved for *IS-95* signaling systems are covered with the following channel numbering scheme:

6.2.2.xx Public Long Code

This element is a fixed length element. It contains Public Long Code.

7	6	5	4	3	2	1	0	Octet
Element Identifier								1
Length								2
LSB	Public Long Code							3
Public Long Code							MSB	8

The Length indicator (octet 2) is a binary number indicating the absolute length of the contents after the length indicator octet. The Algorithm-Info field is coded as follows:

Public Longcode: The length is 42 bits, encoded in 6 octets, such that the 6 unused bits are set equal to '0', and occupy the high-order positions of the most significant octet.

6.2.2.xx CE Node ID

This information element identifies the network node that contains the instance of the Channel Element (CE) in use for the call.

7	6	5	4	3	2	1	0	octet
Element Identifier								1
Length								2
Type								2
(MSB)								3
CE Node Identifier								...
							(LSB)	variable

Length: This field indicates the number of octets that follow, including the number of octets in both the Type and CE Node Identifier fields.

Type: This field indicates the type and format of the CE Node Identifier that follows.

Type	Format of the SDU Node Identifier	Length of CE Node Identifier
1	No format is specified.	Variable
2	Internet Protocol IPv4	4 octets
3	Internet Protocol IPv6	variable
All other values	Reserved	

CE Node Identifier: This field has a variable length that is dependent on the Type field. The internal format of this field may be specified via the Type field.

6.2.2.xx CE ID

This information element identifies a particular CE instance within an CE Node.

7	6	5	4	3	2	1	0	octet
Element Identifier								1
Length								2
(MSB)								3
CE Identifier								...
							(LSB)	variable

Length: This field indicates the number of octets in the CE Identifier field.

CE Identifier: This field has a variable length. The actual length is indicated in the Length field and is dependent upon the particular implementation.

6.2.2.xx Power Control Subchannel Count

This information element indicates the number of subchannel involved in a soft handoff for power control purposes.

7	6	5	4	3	2	1	0	octet
Element Identifier								1
Length								2
Subchannel Count								3

WHAT IS CLAIMED IS:

1. A method of establishing a soft handoff comprising the steps of:

sending a resource allocation message from a source base station (BS) directly to a target BS on a signaling first link;

establishing and completing a traffic connection between the target BS and a source selection/distribution unit (SDU) via a direct signaling connection between a source system and a target BS using a signaling second link; and

transferring voice signals between said source (SDU) and said target BS over a traffic link.

2. The method of claim 1 wherein:

the soft handoff is of a mobile station (MS) between a source BS and a target BS in a code division multiple access (CDMA) mobile communication system.

3. The method of claim 1 wherein:

said signaling first link conforms to an industry standardized protocol known in the art as A7; and

said signaling second link conforms to an industry standardized protocol known in the art as A3S.

4. Apparatus for establishing a soft handoff comprising:

means for sending a resource allocation message from a source (BS) directly to a target BS on a signaling first link;

means for establishing and completing a traffic connection between the target BS and a source selection/distribution unit (SDU) via a direct signaling connection between a source system and a target BS using a signaling second link; and

means for transferring voice signals between said source (SDU) and said target BS over a traffic link.

5. Apparatus as claimed in claim 4 wherein

the soft handoff is of a mobile station (MS) between a source BS and a target BS in a code division multiple access (CDMA) mobile communication system.

6. The apparatus of claim 4 wherein:

said signaling first link conforms to an industry standardized protocol known in the art as A7; and

said signaling second link conforms to an industry standardized protocol known in the art as A3S.

7. A method of initiating the establishment of a soft handoff between source and target base stations (BS) each comprising a part of different type architecture systems comprising the single step of:

sending a resource allocation message from a source base station (BS) directly to a target BS.

8. The method of claim 7 wherein:

the resource allocation message is sent from one of an Architecture A type system and an Architecture B type system to the other of said Architecture A and Architecture B type systems.

9. The method of claim 7 wherein:

said resource allocation message is sent over a communication link conforming to an industry standardized protocol known in the art as A7.

10. Apparatus for initiating the establishment of a soft handoff between source and target base stations (BS) comprising:

a target BS comprising a part of a first architecture type system;

a source BS comprising a part of a architecture type system differing from said first architecture type system; and

means for sending a resource allocation message from said source BS directly to said target BS.

11. The apparatus of claim 10 wherein:

the resource allocation message is sent from one of an Architecture A type system and an Architecture B type system to the other of said Architecture A and Architecture B type systems.

12. The apparatus of claim 10 wherein:

said means for sending a resource allocation message from said source BS directly to said target BS conforms to an industry standardized protocol known in the art as A7.

FIG. 1 (PRIOR ART)

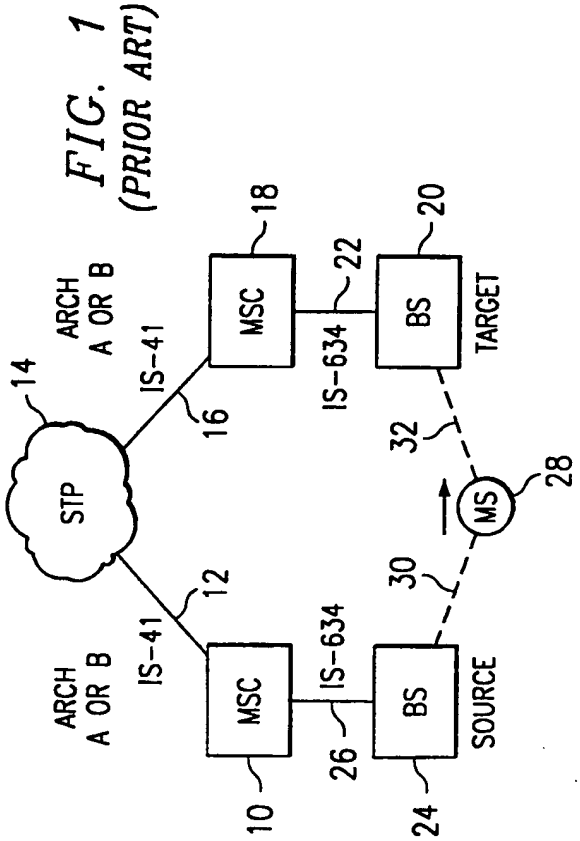


FIG. 2 (PRIOR ART)

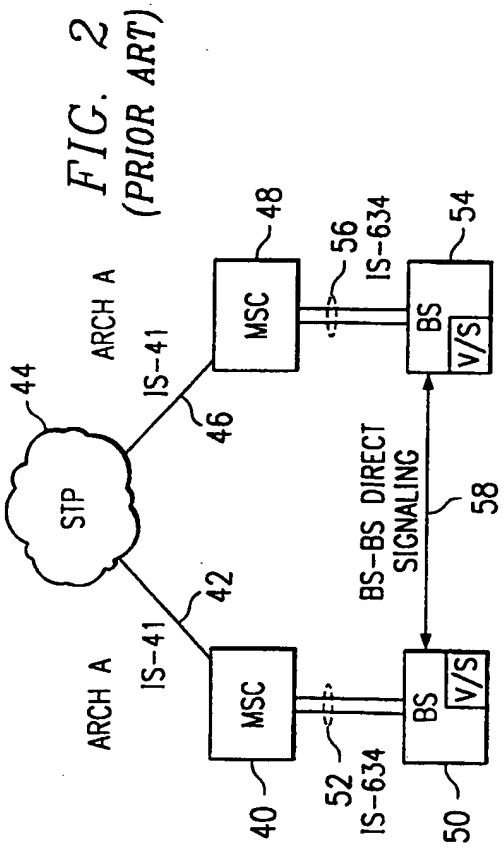


FIG. 3

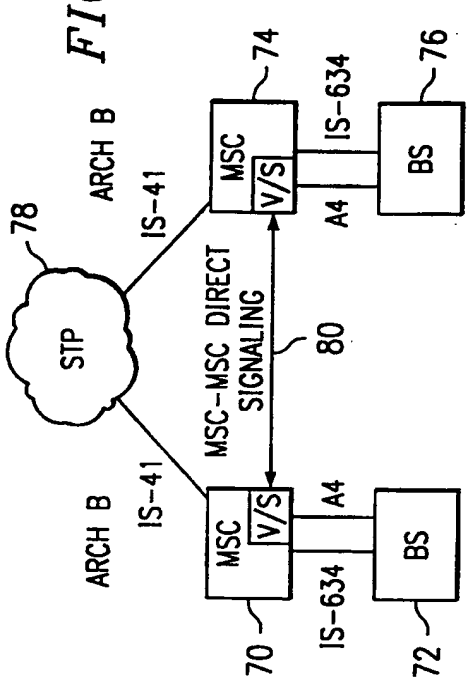


FIG. 4

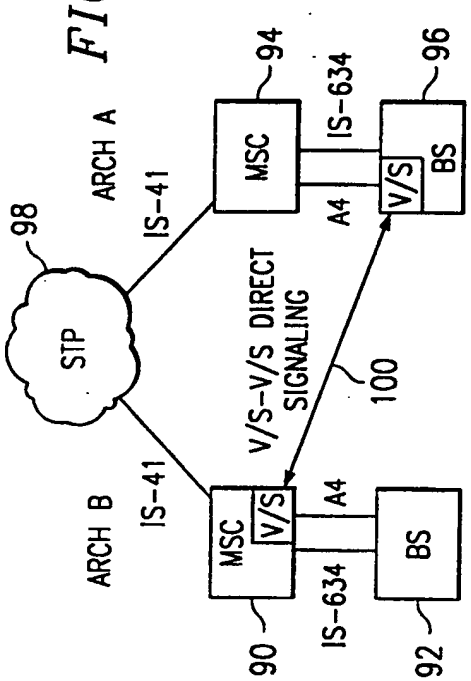
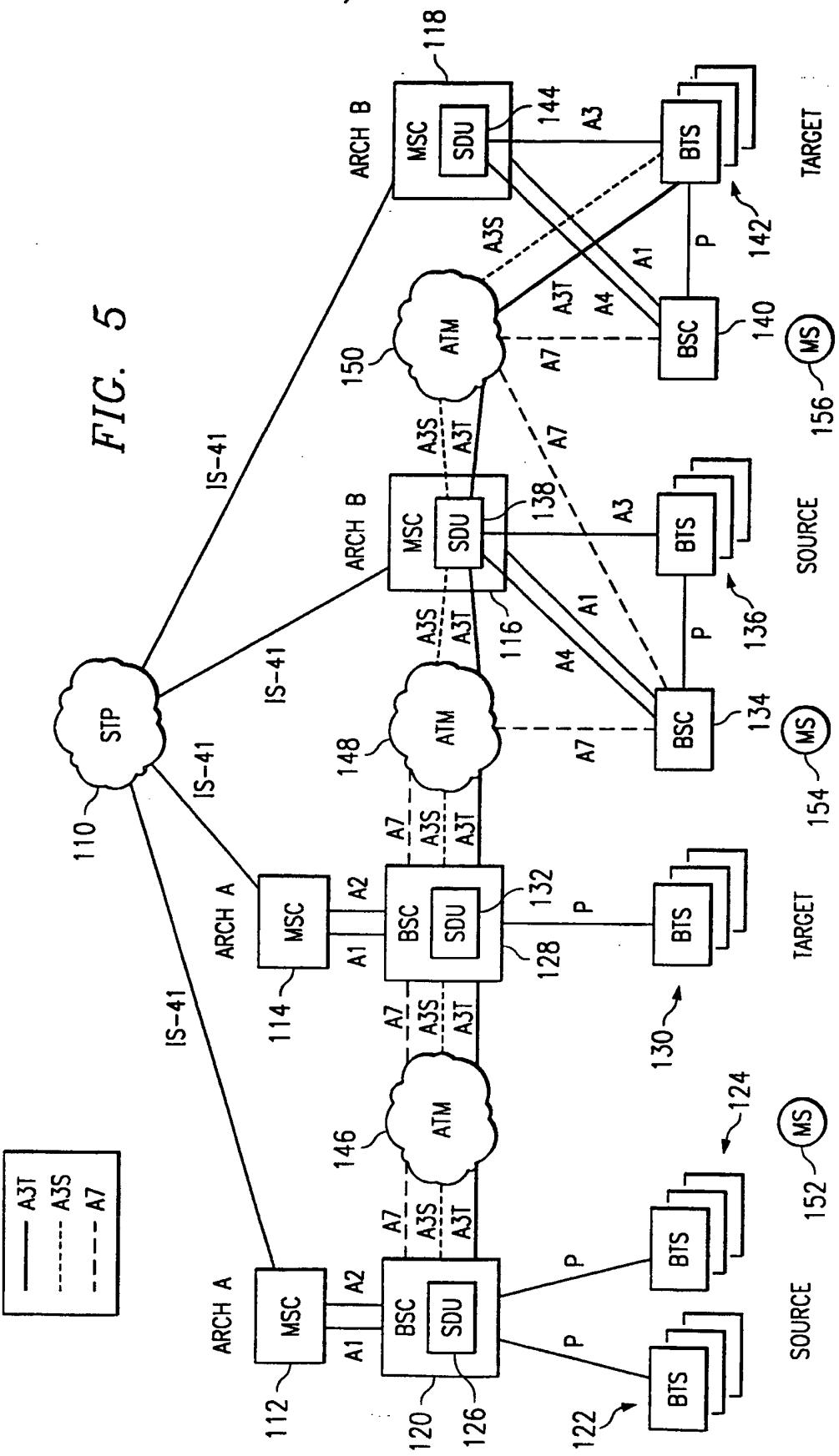


FIG. 5


A3T
A3S
A7
STP
110
IS-41
IS-41
IS-41
IS-41
ARCH A
MSC
A2
A1
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112
114
ARCH B
MSC
SDU
118
116
ATM
146
148
150
A7
A3S
A3T
A3
A4
A1
P
BTS
120
122
126
128
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132
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138
140
142
144
124
152
154
156
TARGET
SOURCE
MS

FIG. 6

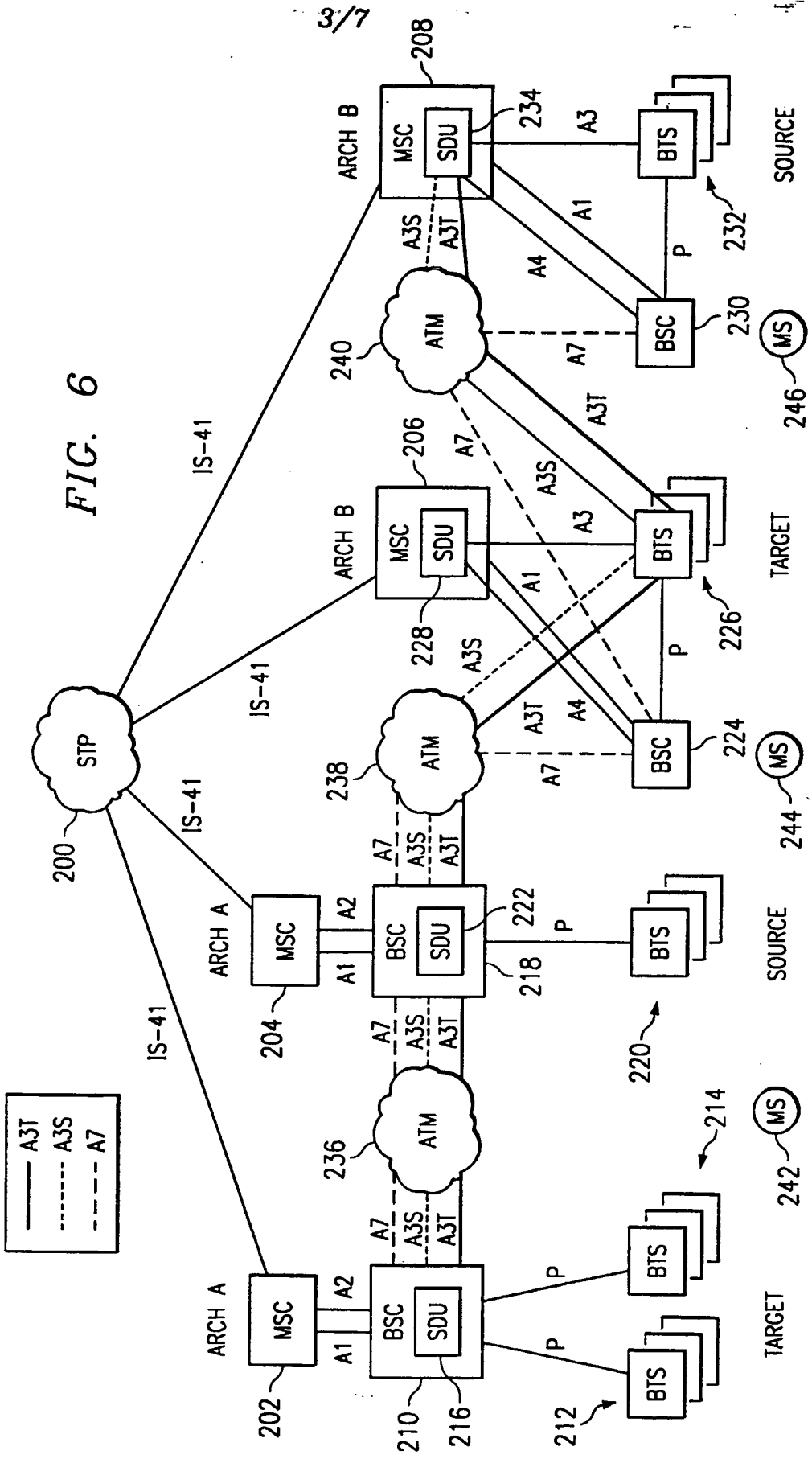

A3T
A3S
A7
STP
200
IS-41
IS-41
IS-41
IS-41
ARCH A
MSC
202
A1
A2
BSC
SDU
210
216
ARCH A
MSC
204
A1
A2
BSC
SDU
218
222
ARCH B
MSC
206
SDU
228
ARCH B
MSC
208
SDU
234
ATM
236
ATM
238
ATM
240
A7
A3S
A3T
A4
A3
A1
P
BTS
212
BTS
214
BTS
220
BTS
226
BTS
230
BTS
232
BSC
224
BSC
230
MS
242
MS
244
MS
246
TARGET
SOURCE
TARGET
SOURCE

FIG. 7

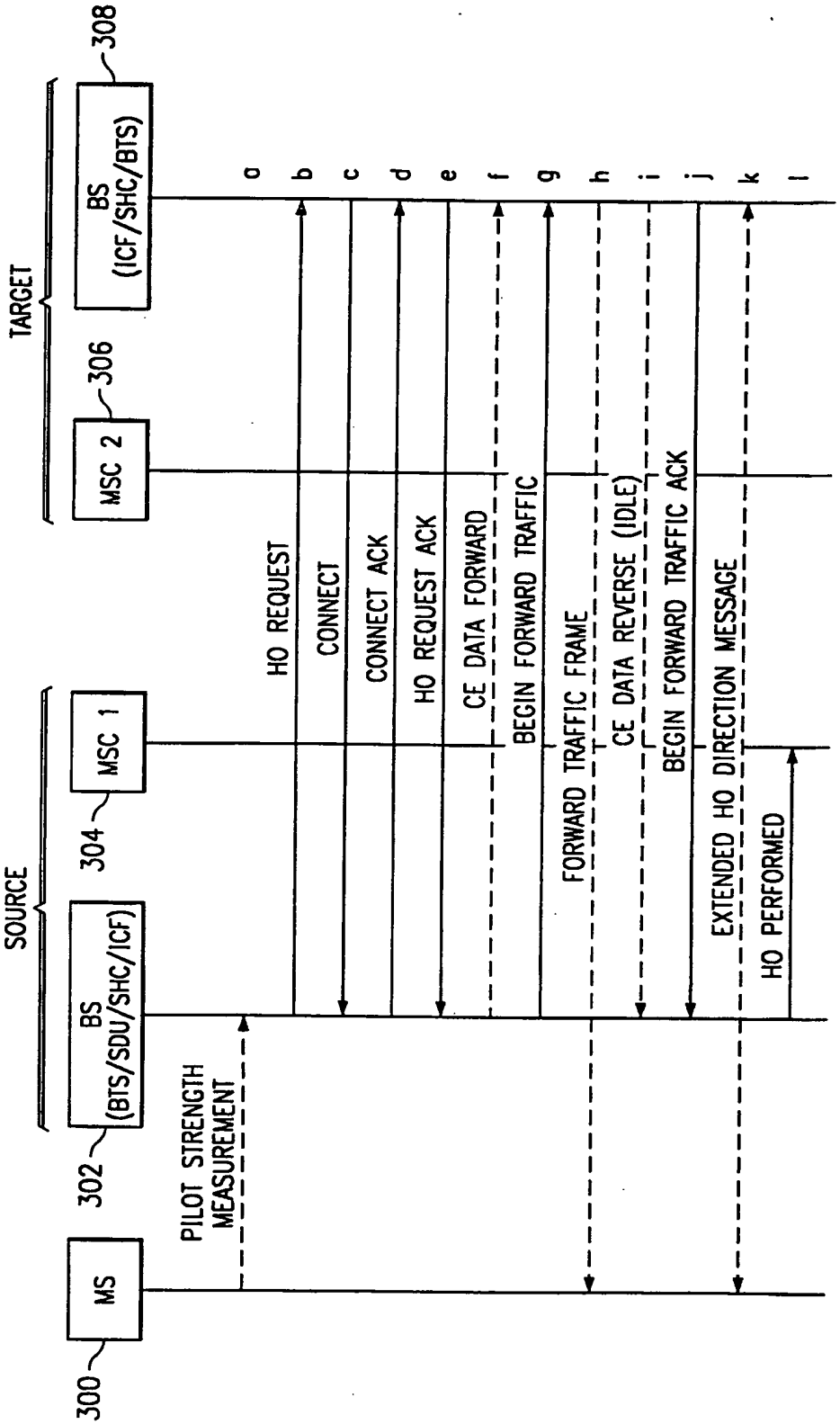
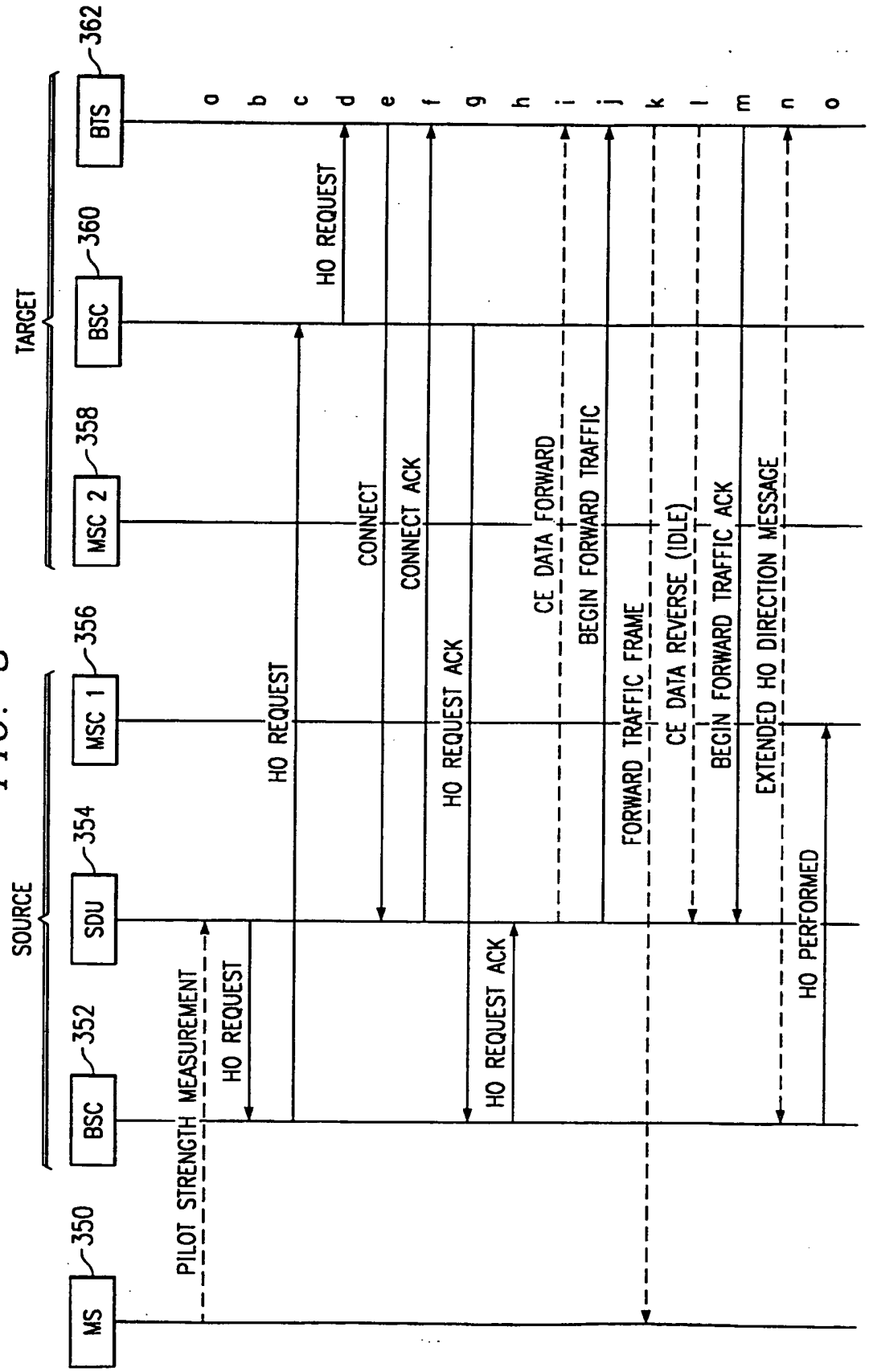

TARGET
SOURCE
BS (ICF/SHC/BTS)
308
MSC 2
306
MSC 1
304
BS (BTS/SDU/SHC/ICF)
302
MS
300
a
b
c
d
e
f
g
h
i
j
k
l
HO REQUEST
CONNECT
CONNECT ACK
HO REQUEST ACK
CE DATA FORWARD
BEGIN FORWARD TRAFFIC
FORWARD TRAFFIC FRAME
CE DATA REVERSE (IDLE)
BEGIN FORWARD TRAFFIC ACK
EXTENDED HO DIRECTION MESSAGE
HO PERFORMED
PILOT STRENGTH MEASUREMENT

FIG. 8


MS
350
BSC
352
SDU
354
MSC 1
356
MSC 2
358
BSC
360
BTS
362
SOURCE
TARGET
a
b
c
d
e
f
g
h
i
j
k
l
m
n
o
PILOT STRENGTH MEASUREMENT
HO REQUEST
HO REQUEST
HO REQUEST
CONNECT
CONNECT ACK
HO REQUEST ACK
HO REQUEST ACK
CE DATA FORWARD
BEGIN FORWARD TRAFFIC
FORWARD TRAFFIC FRAME
CE DATA REVERSE (IDLE)
BEGIN FORWARD TRAFFIC ACK
EXTENDED HO DIRECTION MESSAGE
HO PERFORMED

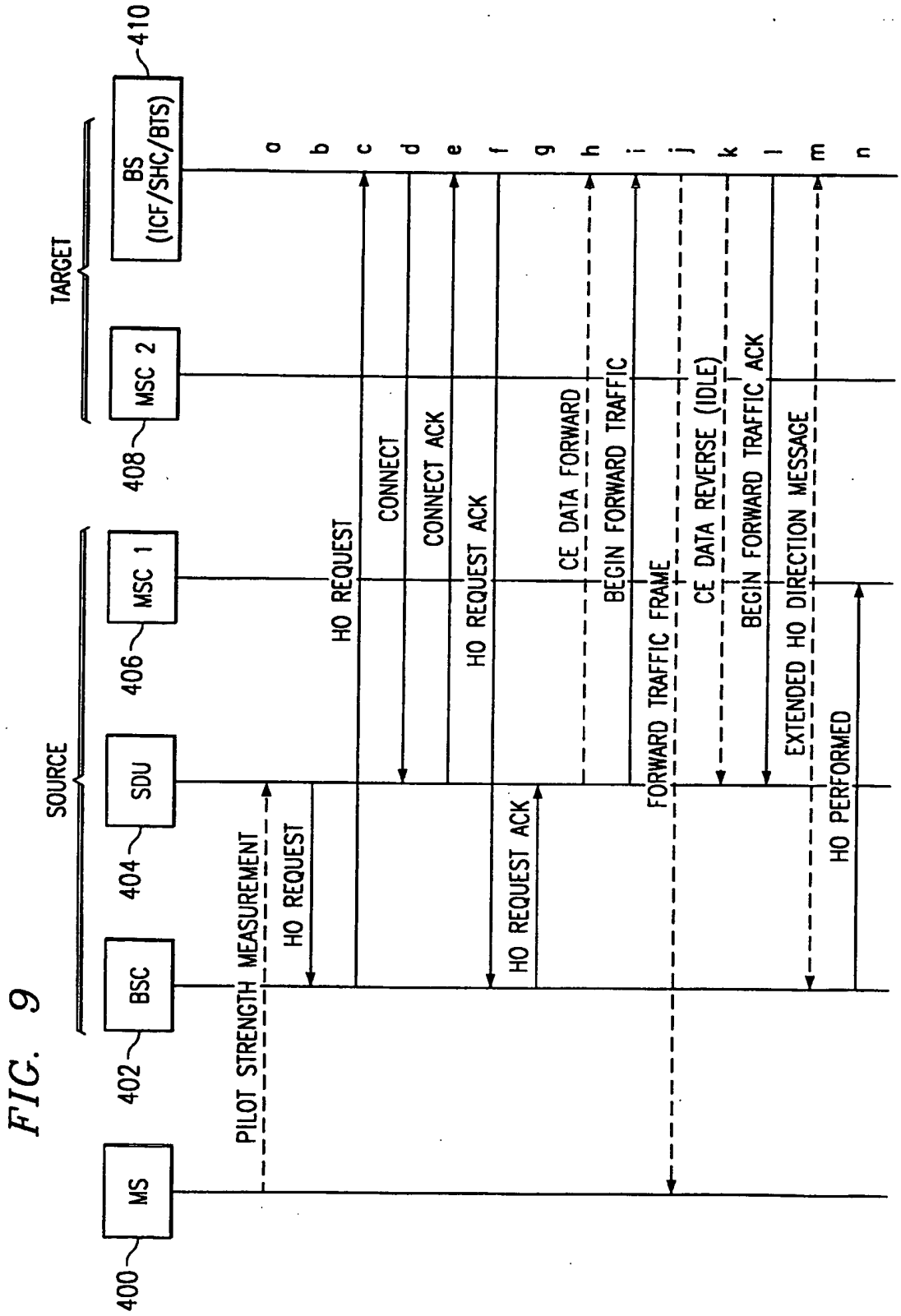
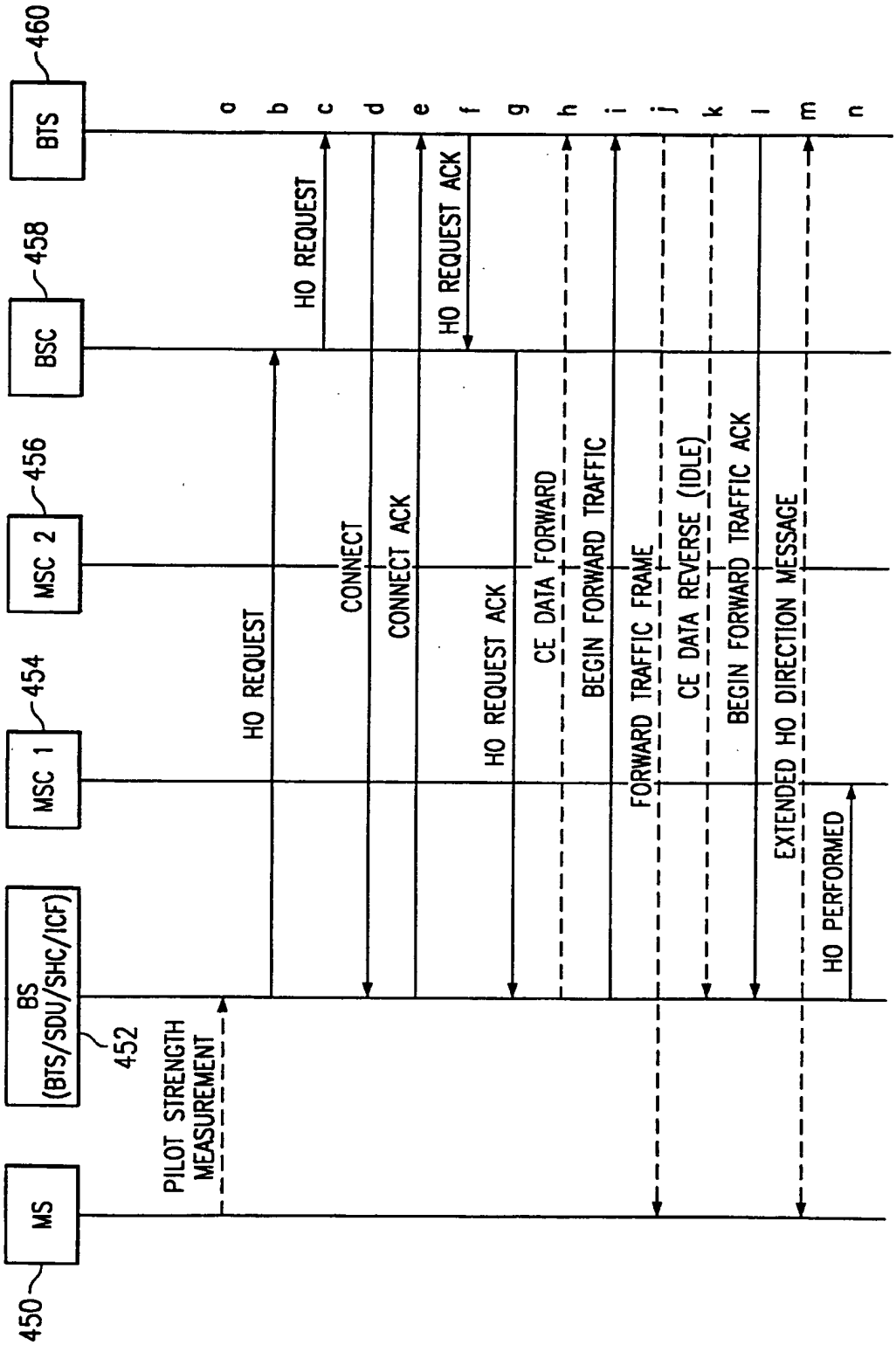

MS
400
BSC
402
SDU
404
MSC 1
406
MSC 2
408
BS (ICF/SHC/BTS)
410
SOURCE
TARGET
a
b
c
d
e
f
g
h
i
j
k
l
m
n
PILOT STRENGTH MEASUREMENT
HO REQUEST
HO REQUEST
CONNECT
CONNECT ACK
HO REQUEST ACK
HO REQUEST ACK
CE DATA FORWARD
BEGIN FORWARD TRAFFIC
FORWARD TRAFFIC FRAME
CE DATA REVERSE (IDLE)
BEGIN FORWARD TRAFFIC ACK
EXTENDED HO DIRECTION MESSAGE
HO PERFORMED

FIG. 9

FIG. 10


450
MS
452
BS
(BTS/SDU/SHC/ICF)
454
MSC 1
456
MSC 2
458
BSC
460
BTS
SOURCE
TARGET
a
b
c
d
e
f
g
h
i
j
k
l
m
n
PILOT STRENGTH MEASUREMENT
HO REQUEST
HO REQUEST
CONNECT
CONNECT ACK
HO REQUEST ACK
HO REQUEST ACK
CE DATA FORWARD
BEGIN FORWARD TRAFFIC
FORWARD TRAFFIC FRAME
CE DATA REVERSE (IDLE)
BEGIN FORWARD TRAFFIC ACK
EXTENDED HO DIRECTION MESSAGE
HO PERFORMED

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/15048

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H04Q7/38

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	YOON C ET AL: "HANDOVER SCHEMES FOR ITS-COMBINED ATM-BASED MOBILE MULTIMEDIA COMMUNICATION SYSTEM" 1997 IEEE 47TH. VEHICULAR TECHNOLOGY CONFERENCE, PHOENIX, MAY 4 - 7, 1997, vol. 1, no. CONF. 47, 4 May 1997, pages 135-139, XP000701773 INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS see page 137 - page 138 -/--	1,4,7,10

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
26 October 1998	02/11/1998

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 98/15048

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	YUAN R ET AL: "A SIGNALING AND CONTROL ARCHITECTURE FOR MOBILITY SUPPORT IN WIRELESS ATM NETWORKS" 1996 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC), CONVERGING TECHNOLOGIES FOR TOMORROW'S APPLICATIONS DALLAS, JUNE 23 - 27, 1996, vol. 1, 23 June 1996, pages 478-484, XP000625718 INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS	1,4,7,10
A	CHEN W: "IMPACT OF ANCHOR RE-ROUTING BASED INTER-SWITCH HANDOFFS IN WIRELESSATM ACCESS NETWORKS" 1996 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (ICC), CONVERGING TECHNOLOGIES FOR TOMORROW'S APPLICATIONS DALLAS, JUNE 23 - 27, 1996, vol. 1, 23 June 1996, pages 235-239, XP000625674 INSTITUTE OF ELECTRICAL & ELECTRONICS ENGINEERS	1,4,7,10
A	US 5 471 644 A (BONTA JEFFREY D ET AL) 28 November 1995 see column 3, line 51 - line 59	1,4,7,10
A	WO 96 36191 A (MOTOROLA INC) 14 November 1996 see page 4, line 26 - line 31; figure 1	1,4,7,10
E	WO 98 36612 A (NOKIA TELECOMMUNICATIONS OY ;VIALEN JUKKA (FI); MAEENPAEAE SANNA ()) 20 August 1998 see abstract; figure 1	1,4,7,10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 98/15048

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5471644 A	28-11-1995	IL 109690 A	10-06-1997
		JP 8502637 T	19-03-1996
		SE 9500676 A	24-05-1995
		WO 9504437 A	09-02-1995
WO 9636191 A	14-11-1996	US 5682416 A	28-10-1997
		BR 9606324 A	16-09-1997
		CA 2193506 A	14-11-1996
		EP 0770312 A	02-05-1997
		FI 965195 A	23-12-1996
		JP 10503354 T	24-03-1998
WO 9836612 A	20-08-1998	NONE	